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REFORESTATION INSTRUCTIONS

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

EASTERN DISTRICT

ADDRESS REPLY TO
DISTRICT FORESTER
AND REFER TO

WASHINGTON, D.C.

S-Planting
D-7

March 1, 1929.

Forest Officer,

The attached instructions have been prepared as a guide to reforestation work in the Eastern District and supercede all existing instructions. With the recognition of our reforestation needs afforded by increased planting allotments, comes the responsibility for definite results in acres successfully reforested at lowest unit costs. These instructions lay the foundation for adequate, uniform, and practical nursery and planting practice. They are intended to supplement the reforestation section of the National Forest Manual, and should be used by field officers and District inspectors with this in mind.

Your attention is particularly directed to the instructions for Planting Surveys and for records of plantations.

Additions and revisions will be issued periodically as necessary. Each Forest officer using these instructions should consider it his duty to recommend such additions or revisions as he deems desirable.

Very truly yours,

EVAN W. KELLEY,
District Forester

By: R. M. EVANS, Acting.

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REFORESTATION

See instructions on pages 129-S to 135-S of the Manual. Department Bulletin 475, "Reforestation on the National Forests," should be in the library of each planting Forest, and Department Bulletin 479, "Nursery Practice on the National Forests," in each Nursery library. Planting and nursery men should be familiar with these bulletins, and with instructions in the Manual.

PLANTING SURVEYS

Necessity for Planting Surveys

Each Forest engaging in reforestation must have a planting plan. In some cases, this may be only a brief statement of the problem with a general plan to reforest each year a few acres, in order to secure a more valuable stand than would otherwise result, and to create and maintain favorable public sentiment.

Those Forests, however, which contain extensive areas in need of reforestation must approach the problem of planting plans more methodically. In such cases, planting surveys are necessary:

1. To locate, define, map, and analyze areas needing reforestation;

2. To arrange these in logical projects and set up a priority list among projects;

3. Based upon 1 and 2, and on availability of funds for nurseries and planting, to work out and put into effect a forest planting plan.

Definition of "Planting Project" and "Plantation"

A planting project is an area or a group of small scattered areas needing reforestation. It is a classification used primarily as an aid in maintaining planting records. Such records are necessary in order to judge results, both from silvicultural and financial standpoints. An extensive area to be planted, such as a burn, may be designated as a project. Smaller areas, such as old fields or small burns within a ranger district, or working circle, may be grouped into a single project. It may sometimes be desirable to carry an "experimental project" for a whole Forest, consisting of small, scattered miscellaneous plantations, but ordinarily such areas should be included as a part of the reforestation of a major project.

Each project is named, for example: Canaan Mountain Project, Dilley Hollow Project, Deerfield Project, South Toe Project.

As stated in the Manual on page 132-S:

"Each area planted or sown will be given a project name, preferably that of some local topographic feature. Each subdivision of this project area which is planted or sown with different species, mixtures, age classes, with seed from different sources or trees grown from seed from different sources, or which is planted or sown by different methods, or which is planted or sown at different times will be given a separate number, but small interior patches not exceeding 5% of such a subdivision, planted with different stock, or by different methods, because of varying site conditions, need not be so segregated.

"A single series of consecutive numbers will be used for each project with the letter "P" or "S" prefixed to indicate a plantation or seeding area, as P-1, P-2, S-3, etc. Replanted or reseeded areas should be given separate numbers in the same series as the original areas."

Preliminary Examination and Report

Preliminary examinations and reports will be made by Supervisors or other qualified Forest officers with a view of determining for specific areas whether the conditions warrant the expense of making an intensive examination. The preliminary report should cover briefly the following points:

1. Brief description of project, giving name, location, and approximate gross area.

2. Brief history of area (fires, cutting, etc.), giving reason for present condition.

3. Apparent degree to which area is restocking naturally and desirability of species being reproduced.

4. Probable length of time it will take for area to completely restock itself naturally.

5. Apparent condition of the site as to its ability to support a stand of timber.

6. Recommendations for or against intensive planting surveys with main supporting reasons.

This information should be in memorandum form, and will be the basis for deciding whether intensive examinations should be made.

On small projects, especially the better sites such as old fields and pastures, the preliminary report may well be detailed enough to form a decision as to whether or not planting should be done without going to the further expense of an intensive planting survey. In that case, however, enough information should be given to show conclusively why planting is desirable, what should be planted, and the probable cost.

On medium sized to large projects, especially where there is some doubt as to the need of planting, the preliminary examination will aim to show chiefly whether an intensive survey is warranted, how and when it should be done, and the probable cost from contributed time and planting funds.

Forests having large planting needs should cover each project by a memorandum report. On the basis of these reports and of the priority list built up therefrom, intensive surveys will be conducted. It is necessary to keep reconnaissance far enough ahead of planting to enable the nursery to produce the desired stock, but conditions are too liable to change to warrant the cost of surveys more than ten years in advance of planting.

Intensive Planting Surveys

Intensive planting surveys will be undertaken only after preliminary examination has shown them to be needed to get a true index of conditions; and on large areas or those requiring a special allotment, only after approval by the District Forester. The purposes, methods, and technique of intensive planting surveys follow:

Purposes of Survey

The aim of intensive planting surveys is to secure all pertinent information bearing on the advisability of reforesting an area or any portion of it, and all information that will be helpful in planning and executing reforestation plans.

Essentially, a planting survey job is very similar to a timber survey job, the main point of difference being that one deals with needs, methods, and costs of replacing a stand, while the other deals with the needs, methods and costs of removing a stand.

The very nature of such a survey requires the gathering of considerable detailed information, but perfunctory performance of the

work should be avoided and the main purposes of the job kept clearly in mind. They are as follows:

1. To find out where to plant.
2. To find out what to plant.
3. To find out how to plant and what it will cost.

By constantly keeping these three points in mind, much useless expenditure of money and effort in going into unrelated detail can be avoided.

General Instructions

The information obtained by a planting survey will be recorded in two forms, by mapping and by memorandum. The information each should carry is as follows:

A. Map.

(1) Location and boundaries of areas to be planted, including the two classes of doubtful areas. (See "Reproduction Counts" under "Methods")

(2) Supporting reasons and general conditions in symbol form of areas not to be planted.

(3) Soil condition of area to be planted.

(4) Cover condition of area to be planted.

(5) Species to be planted and number per acre.

(6) Main topographic features, including streams, roads, trails, main ridges, logical planting unit boundaries (similar to logging unit), compartment and working circle boundaries, and in brief, all pertinent information.

In this connection, bear in mind that we are chiefly interested only in the areas that need planting, and beyond defining boundaries, general condition, and main topographic features, little time should be spent on areas not in need of planting, except as they directly affect the other.

(7) In addition to the present physical improvements actually on the ground, there should be shown such roads, trails, camps, and other improvements as will be needed for carrying out a planting job and for

the protection of plantations, each bearing a project number. If necessary, a separate print may be used to show needed improvements.

The foregoing information will be recorded on the base map in accordance with the legend on Page 13, and other desirable information can be shown by the use of standard map symbols.

B. Memorandum or Report

This should contain a brief description of the project as a whole, the method of treatment recommended for each compartment or unit, definite recommendations for planning and carrying out recommended treatment, and a detailed estimate of the cost, exclusive of seed or planting material. The following outline should be followed, adding any other pertinent matter. Copies of the report and map will be prepared for Ranger, Supervisor, and District Forester.

(1) General description of the area as a whole, including name, location, altitude, topography, soil, history, present condition of cover, original forest types, present adaptability to supporting such types, fire hazards, etc.

(2) Description of climate, including amount and distribution of precipitation, frosts, amount and duration of snow, etc.

(3) Need for artificial reforestation, showing probable period before area will restock naturally, purposes which a forest cover will serve (timber production, watershed protection, etc.)

(4) a. Division into compartments and units and treatment recommended for each with detailed description of recommended methods of sowing, planting preparation of soil, etc., showing clearly the reasons for selecting the recommended treatment in preference to others.

b. Tabulated summaries for all compartments, units, and sub-units, using the following forms:

Summary by Compartments

Compt. Number	Unit	Acres	Methods	Species	Quantity seed or plants	
					Per Acre	Total
Totals						

Summary by Species and Methods

Species	Methods	Area	Lbs. Seed	No. Plants		
				1-0	1-1	etc.

(5) Period during which work should be done, including planting season, number of acres to be planted per year, and number of years required to do the job.

(6) Protection measures recommended:

a. From rodents.

b. From grazing.

c. From fire.

d. From overcrowding during the first few years.

(7) Brief discussion of areas not recommended for reforestation, with supporting reasons if not clearly shown on map.

(8) a. Definite recommendations as to organization, equipment, and improvements for carrying out the work in a businesslike manner.

b. Detailed estimate of costs.

Organization and Equipment

Two man crews (consisting of topographer and compassman) will be used. When two or more crews are used on a job, one of the topographers will be designated as Chief of Party. Junior Foresters, Rangers, and Forest School students should be used.

Equipment used will be essentially the same as that used on timber surveys. Special equipment such as chains, tentage, stoves, cook outfits, and planting tools, purchased from planting funds for use of planting surveys, nursery work, and field planting must be segregated from other equipment and used only for the purposes intended.

Cost records on each project must be maintained by the Chief of Party. Form 134 contains a space for "Depreciation and Reconnaissance." Depreciation includes the annual charges for all equipment used for planting surveys and field planting. Each item should be depreciated over its estimated life, but periods longer than ten years will not ordinarily be used. Total planting survey costs and cost per acre will be computed for each project. This cost per acre, added to the depreciation charge per acre (arrived at by dividing the annual depreciation charge by the number of acres planted) will give the figure for use on Form 134.

Methods

A. Control

Control will be handled on individual forests in accordance with approved timber survey methods, taking full advantage of established survey lines, etc. Base line stations should be made permanent enough so that they will serve for tying-in plantations subsequently made, and should be shown on the tracing. A traverse board, plane table, or standard compass and Jacob staff, together with a five chain tape, is the most efficient outfit for base line work.

B. Cruising

Cruise lines or strips should be laid out in accordance with approved timber survey methods for individual forests and should ordinarily be 20 chains apart (10 chains apart may occasionally be justified). In the areas patently not to be planted, only enough strips will be run as may be necessary to establish their condition with reasonable accuracy. Strips will be run across the main topography and will be tied in to a base line or control at one or both ends. A standard Forest Service compass with Jacob's staff should be used to obtain the desired degree of accuracy. Under most conditions, a two-chain steel tape will be the most satisfactory for use on strips. On some projects, it may be practicable to use a traverse board in stripping.

C. Mapping.

The topographer (rear chainman) will map type lines, topography, culture, sample plots, and other pertinent data (See page "A. Map") on each strip, using a field notebook and a convenient scale (not less than 4"=1 mile). Ties to base line stations, established corners, etc., will be noted.

Elevation is important only as it affects the site, and contour lines ordinarily are unnecessary. It will, however, be well to record approximate controlling elevations of the area. This can be done by reference to U.S.G.S. sheets where they are available.

Each notebook page will be dated and numbered. These, together with base line notes, tally sheets, etc., will be systematically filed, after having been entered on the base map, as a part of the permanent record of the project.

D. Reproduction Counts.

Reproduction counts will be taken by the line plot system, the interval and size of the plots depending largely on the evident conditions as found and the judgment of the Party Chief.

The line plots may be 13.2 feet (20 links) by 1 chain or 6.6 feet (10 links) by 2 chains, either of which is equal to 1/50 acre. In taking these plots, the topographer carries a stick half the width of the plot, laying this on either side of the chain to determine the exact width of the plot and calling out reproduction, saplings, and seed trees by species. The compassman tallies these on Form No. 46-D-7, Planting Surveys Tally Sheet. If necessary, to obtain a clearer picture of average conditions, two or more contiguous plots may be recorded on the same sheet, making appropriate entries as to length and area.

Before starting the survey, it is necessary to decide what constitutes desirable reproduction, (species, size, seedlings, sprouts, etc.) This must be decided for each Forest, because species classed as desirable on one Forest may be considered as only scrubs elsewhere in the District. Again, sprouts of certain species may be relied upon to produce timber trees, while sprout reproduction of other species may be worthless. It is also essential to record for each plot the number and species of saplings and seed trees on a strip one chain wide (1/10 acre if the plot is one chain long, 1/5 acre if plot is two chains long). All tallies are easily convertible to an acre basis.

Form 46-D.7

PROJECT_____ (1) STRIP NO.__ (2) BEG._____ (3) PLOT LETTER_____ (4) FROM_____ TO_____

(5) Reprod. S & ST: Width: _____ : _____ Acres: _____ : _____ (6) PAGE NO.__

(7) SLOPE	(8) ASPECT				(9) TALLIED BY			TOPOGRAPHER			COURSE (10) (Mag. True)			DATE	
(11) SPECIES	Y.B.	R.M.	S.M.	W.A.	B.C.	Y.P.	Cu.				H.	W.P.	R.S.	(12) Total on Plot	(13) Total per A.
(14) REPRODUCTION Sd:															
Sp:															
(15) TOTALS Sd:															
Sp:															
Total:															
(16) SAPLINGS Sd:															
Sp:															
(16) TOTALS Sd:															
Sp:															
Total:															
(17) SEED TREES															
(15) TOTAL															

(18)
SOIL: Character_____ Depth_____ Eroded?_____

(19)
GROUND COVER: Composition_____ Density_____

(20)
BRUSH: Composition_____ Density_____

(21)
REMARKS:_____

(1), (2), refer to instructions on Form 46a-D7.

Form 46a-D.7

PASTE THIS SHEET INSIDE FRONT COVER OF TATUM HOLDER.
COMPLETE EACH TALLY SHEET WHEN PLOT IS TAKEN.

(1) Strips will be numbered in a single series for each Project.
(2) Base line station or corner from which strip is started.
(3) Plots will be lettered A, B, C, etc., single series for each strip.
(4) Indicate the location on strip as "from 38 to 40" (chains).
(5) Reproduction will ordinarily be tallied on a strip .1 chain wide, saplings and seed trees on a strip 1 chain wide. If plot is 2 chains long (usual length), the reproduction plot is 1/50 acre; the S and ST plot 1/5 acre.
(6) Topographer's notebook page number.
(7) Flat; gentle; steep; with approximate percentage.
(8) Flat; north, south, etc.
(9) Signature of compassman and topographer.
(10) Cross out word not applicable, enter bearing of strip.
(11)

Y.B.	Yellow Birch	B.C.	Black Cherry	W.P.	White Pine
R.M.	Red Maple	Y.P.	Yellow Pine	R.S.	Red Spruce
S.M.	Sugar Maple	Cu.	Cucumber		
W.A.	White Ash	H.	Hemlock		

(12) Add each "Total" column horizontally.
(13) Multiply each "Total on Plot" by proper factor (5).
(14) Seedlings (Sd) and sprouts (Sp) less than 10' in height. If desirable, and when so instructed by the Supervisor, sprout reproduction on designated projects will be tallied by clumps rather than by individual sprouts. Whenever this is done, it must be discussed in the report.
(15) Topographer should total each column by species and classes (reproduction --Sd and Sp--; saplings --Sd and Sp--; and seed trees), and compute (12) and (13) immediately after each plot is recorded.
(16) Seedlings (Sd) and sprouts (Sp) more than 10' high and less than 6" to 10" D.B.H. The distinction between saplings and seed trees should be based on the size (age) which must be attained by various species to function as seed trees.
(17) Trees 6" to 10" D.B.H. (depending on species) and larger, capable of producing seed.
(18) Name (if known). Terse description (clay, loam, rocky, boulders, etc.). Moist, well drained, etc.
(19) Includes moss, grass, annual weeds, etc. Brief list of species. Light, medium, or dense.
(20) Unmerchantable species: pin cherry, aspen, rhododendron, laurel, blackberries, etc. Light, Medium, or Dense.
(21) State whether plot is representative of the nearby area. If not, what difference? State whether sprout reproduction is tallied by clumps or individuals. Other pertinent observations.

E. Base Map.

The Party Chief will be responsible for the building up of the base map. He will personally transcribe the data from the field notes to the base map or select another topographer for the work. That is, it will be the individual responsibility of one man to see that the mapping is done correctly and all information checked and correlated.

Field data must be entered daily, so that any discrepancies may be noted and corrected immediately. Inking should be done in the field, in order to preserve the information on the map. Red ink will be used for showing cruise strips and plots, black ink for other data. Each strip will be plotted as actually tied in, rather than as it was planned to run it, thus making the map as accurate as possible.

The following division in density of reproduction based on plots counted will be typed:

I. Less than 100 seedlings per acre of major forest species adapted to the site. Species should be named.

II. More than 100 seedlings as above, but not over 250. Planting is doubtful on such areas, but they will be mapped in detail the same as I.

III. Between 250 and 500 seedlings per acre. Planting is doubtful on such areas, but they will be mapped in detail the same as I.

IV. Over 500 seedlings per acre. Such areas will not be considered for planting and need not be mapped in detail. The reason for not planting should, however, be shown by use of proper symbols.

F. Tracings and Prints.

Inking in the base map should be done in the field, but it is usually best to make the tracing in the office. After completion of the tracing, sufficient prints should be requisitioned for working purposes and to accompany each copy of the report.

The prints accompanying the three copies of the report will be used as progress maps on which to record the progress of planting on the project. Each will have the areas of reproduction, Classes I, II, and III, outlined in the following colors, preferably in ink:

I. (Less than 100 seedlings per acre) - red.

II. (100 to 250 seedlings per acre) - green.

III. (250 to 500 seedlings per acre) - blue.

G. Legend

General

Type line - to define density of reproduction.

Unit Boundary.

Compartment Boundary.

Working Circle Boundary.

Trail available.

Trail needed.

Road available.

Road needed.

Planting Camp Site.

Areas Not to be Planted

Show reason by symbols.

B-Barren

W-Too wet.

A-Needed for Administrative Use.

Bsh-Brush too dense.

G-Grazing highest use.

Species symbol - already restocked to species noted.

Species symbol ST - Seed trees of species noted.

No., date and species - areas already planted.

Areas to be Planted

Note:-All hatching spaced 3/10 inch.

Soil

Good deep soil.

Fair Soil.

Stony or shallow.

Very stony or shallow.

S-1000 Species and number per acre that should be planted.

S-II Species and density class of reproduction.

Cover

Up to 50% ground cover.

Dense underbrush.

Down timber, which will interfere with planting.

Abbreviations for Species

Species	Symbol	Species	Symbol
White Pine	WP	Hemlock	H
Norway Pine	NP	Balsam Fir)	
Shortleaf Pine	SLP	Southern Balsam Fir)	F
Longleaf Pine	LP	Black Walnut	BW
Slash Pine	SP	Red Oak	RO
Red Spruce	RS	White Ash	WA
White Spruce	WS	Black Cherry	BC
Norway Spruce	NS	Yellow Poplar	UP
European Larch	EL	Black Locust	BL
Japanese Larch	JL		

PLANTING PLANS

Forests having planting problems serious enough to warrant planting surveys (extensive or intensive) need concise, workable planting plans, based upon the results of the surveys. The planting plan should summarize the information contained in the planting survey reports and maps. It will contain a priority list of projects, an annual program, and any specific information regarding improvements, man-power and equipment, necessary to the orderly carrying out of this program. It will also stress the measures necessary to adequate protection of plantations. Revisions will be necessary as new data become available. Each plan should provide for a thorough review and revision, at least every five years. Annual estimates for nurseries, planting, and protection of plantations can be compiled as needed from the planting plan and the planting survey reports. Planting plans will be submitted to the District Forester for approval.

DIRECT SEEDING

In this District, direct seeding has been used successfully in the establishment of black walnut stands, notably on the Natural Bridge Forest. This species is, however, fastidious as to soil requirements. It requires a rich, deep, moist, but well-drained soil. Careful judgment is essential in choosing sites for walnut seeding. The chief factors influencing the success of this method are (1) rodetns, (2) treatment of nuts, (3) season of sowing, and (4) grazing on seeded areas.

Rodents, if plentiful, may dig up the nuts, especially in the absence of abundant supplies of other food. The number of squirrels, chipmunks, etc., near an area should be considered before a decision is reached to seed it to walnuts. The areas seeded are ordinarily too small to warrant poisoning of the rodent population. Rather a year should be chosen when rodents are comparatively scarce, or food particularly abundant.

No satisfactory treatment of nuts which will make them so distasteful to rodents as to materially lessen depredations has been worked out. If such a treatment should be used, the nuts should be hulled prior to treatment. In the absence of treatment, the nuts should be stored in a moist state (or stratified), unhulled, preferably near the planting site.

Fall seeding without storage is worth a trial. In general, seeding should be done in February or March, rather than later in the season. Even so, from 25% to 75% of the nuts will lay over until the second season before germinating. If a "cracking test" shows that 25% or more of the nuts are not viable, two should be planted in each spot.

Grazing is usually injurious to walnut seeding areas. The rich soil suited to growing walnut usually supports an excellent growth of forage plants, resulting in rather heavy grazing. Injury results both from trampling and browsing. All grazing should, therefore, be prohibited for at least five years after seeding.

Direct seeding of other species such as the oaks and yellow poplar may prove to be of value, but at present will be used only experimentally.

NURSERIES

General Policy

Nurseries will be established to supply planting stock to meet the needs of a Forest or group of Forests. Knowing from planting surveys the amount and class of stock needed, it is possible to establish nurseries at centrally located points to supply the needs. A nursery will not be established unless it is clearly evident that sufficient funds will be available to maintain it at an economical capacity. An exception will be made in the case of small nurseries designed to produce stock for purely experimental purposes. Such a plant, however, should be so located that, should the experiments prove expansion feasible, it will be possible to expand to an economical capacity. Where, as on the Allegheny, suitable stock can be purchased at prices at or below the cost of raising it, this will be done.

Size

Small nurseries with a capacity up to 200,000 seedlings or transplants may be operated by Rangers, if conveniently located. Large nurseries will be under the care of a Nurseryman who should have at least Junior Forester qualifications. He will reside at or near the Nursery, and will have his office at the Nursery. This is essential because of the constant and detailed care necessary to successfully grow nursery stock. The minimum capacity for a Nursery of this class is 1,000,000 seedlings or transplants yearly.

Class of Stock

Each Nursery has a definite mission to fulfill. The species, age, and class of stock raised will depend upon the project on which used. The amounts of each class of stock required each year will be determined from planting surveys.

Nursery Practice

Each Nursery is an individual project. Soil, climate, and other factors affect methods and results to such a degree that technique must be carefully worked out. Much can be learned, however, from other nurseries — Forest Service, State and private. The Office of Forest Management will keep the field advised of developments elsewhere.

Accurate records must be kept at each Nursery. Only by careful study of such records will it be possible to determine the best and most economical methods to follow. The maintenance

of an accurate set of Nursery costkeeping records in accordance with mimeographed instructions from the Forester's Office, issued April 28, 1927, is essential. Each Nursery should have a Work Plan (revised as necessary) setting down clearly the jobs to be done, when, and how to do them.

Many problems can best be solved by detailed experiments, often continuing for a period of years. Guidance and help will be obtained from the Forest Experiment Stations.

Small amounts of ornamental stock for use at Ranger Stations, public camp grounds, etc., may be raised as required.

Annual Nursery Report

A report is due in the District Office January 15 each year from each Nursery. The following outline will be used, insofar as it is applicable. Do not repeat each year standard and recognized practices, but emphasize departures or innovations in procedure. Results are always important, and reasons should be stated. Suitable photographs or drawings of new equipment, outstanding results, etc., should be freely used. The report should be prepared by the Nurseryman for the Supervisor's approval. Two copies will be forwarded to the District Office and one each retained in the Supervisor's and Nursery files.

Outline for Annual Nursery Report

1. The Nursery Plant
   a. Total area.
   b. Net area of seed beds. Capacity.
   c. Net area of transplant beds. Capacity.
   d. Crop rotation and maintenance of soil fertility.
   e. Buildings. Maintenance.
   f. Water system. Maintenance.
   g. Other Improvements and Equipment. Maintenance.
   h. Recommended changes.

2. Seed
   a. Source of seed. When and where collected. By whom.
   b. Comparison with seed from other sources.
   c. Methods of storage. Results.
   d. Amount sown per square foot. Method of determination. Results.
   e. Recommended changes.

3. Seedling culture (discuss each age class).
   a. Preparation of seed beds.
   b. Sowing. Fertilization. Results.
   c. Methods of disease and insect control. Results.

d. Mulching, weeding, watering, shading, etc. Results.
e. Estimated quantity of each age class, by species, in beds at close of Nursery year.
f. Size and development of stock by species and age classes.
g. Recommended changes.

4. Transplant Culture (discuss each age class).
   a. Preparation of transplant beds.
   b. Transplanting. Results.
   c. Losses. Causes. Remedies, tried and suggested.
   d. Care of transplants.
   e. Size and development of stock by species and age classes.
   f. Recommended changes.

5. Stock Distribution.
   a. Lifting, storing, packing, shipping.
   b. Stock distributed during year by species, age classes, and Forests. Costs.
   c. Stock available for distribution next year, as in b.

6. Experiments.
   a. Completed. Results.
   b. In progress. Results to date.
   c. Proposed. Purpose, when, how long to complete?
   d. Weather data for the year.

7. Labor.
   a. Supply, suitability, cost.
   b. Recommended changes.

8. Costs.
   a. Detailed costs by projects.
   b. Allotment this fiscal year.
   c. Allotment estimates next fiscal year, by projects.
   d. Comment on any unusual costs, and on requested changes in allotment.

9. Sowing, fertilization, and disease control schedule for next nursery year.
   a. Comment on changes from last year's schedule.

PLANTING

Selection of Projects

As stated in the Manual, the most favorable sites will be selected for planting. It will be standard practice to choose one, or, at the most, two projects on a Forest, completing these before others are started. Good soil, lack of brush, accessibility, and ease of protection are the most important considerations upon which priority of projects will be based. Old fields should be planted if they are not needed for grazing or special use.

Species and Class of Stock

Planting plans should always be based upon planting the species best suited to the particular site. Ordinarily this will be the species which originally grew there. Sometimes changes in the character of the site by cutting or fire, or the prevalence of disease or insect epidemics may require the use of other species. Where possible, experimental plantations of 1 to 10 acres should be made on representative areas in each site to be planted for the purpose of determining species and class of stock best suited to the site. It must be remembered that the Nursery will collect seed and start raising stock for a project 1 to 4 years before the stock is available for field planting. Experimental plantations designed to show the species and class of stock best suited to a particular site must, therefore, be established 5 to 10 years in advance of active reforestation, since at least five growing seasons must ordinarily elapse before even tentative conclusions may be reached.

In general, exotic species will be avoided. Norway spruce has been planted to some extent, but will be largely abandoned in favor of red or white spruce. Norway pine will be given a thorough trial on all White pine sites. Balkan White pine, said to be resistant to the White Pine Blister Rust, will be planted experimentally.

European and Japanese larches apparently will make good growth on well-drained, fertile sites on many Forests. Japanese is preferable to European larch, because it is supposed to be less susceptible to attack by the Larch Saw Fly. Both grow rapidly and will produce durable posts and telephone poles. These species are very intolerant of shade. They may be planted pure or in mixture with more tolerant, slower growing species. For this purpose, small areas of relatively good soil, located where posts and poles will be needed and will be readily accessible, should be chosen. Other exotics will not be planted without prior approval by the District Forester.

As a rule, mixtures are more desirable than pure plantations. Species may be mixed in alternate rows, or by blocks. Only by experiment can the most suitable mixtures for each site be determined.

The class of stock to use depends upon the tree itself and upon the site. In general, hardwoods require better sites than softwoods. Black walnut and yellow poplar are particularly fastidious. The soil, light, and moisture requirements of a species must be kept in mind. Root competition may make transplants necessary where otherwise seedlings would suffice. The following list shows the class of stock which will ordinarily be used:

White Pine Norway Pine	2-1 or 2-0, depending on Nursery where grown, and planting site.
Longleaf Pine Slash Pine Loblolly Pine	1-0
Red Spruce White Spruce Norway Spruce Hemlock Balsam Fir So. Balsam Fir	2-1 On sites where overhead or root competition is severe or where there is danger of smothering, 3-1 stock may be needed. 2-0 and 3-0 stock may prove successful on the Allegheny.
Shortleaf Pine European Larch Japanese Larch	2-0
All Hardwoods	1-0 It is more economical to establish black-walnut by direct seeding than by planting. This may also prove true of some of the oaks.

Time of Planting

Planting will be done as early in the spring as possible. Fall planting is untried in this District except with European larch on the Monongahela. It is desirable with larch, because it is difficult to plant this species early enough in the spring so that growth has not started, which makes survival doubtful. Fall planting of other species is worth a trial, especially on those Forests which have large annual planting programs.

Number of Trees Per Acre

The standard spacing for all regular plantations is 6'x6' (1210 per acre, but usually resulting in approximately 1000 per acre due to rocky soil, brush, and natural reproduction). In inaccessible areas, where thinning will be clearly impracticable, 8'x8' (680 per acre) will be standard spacing. No other spacing will be used, except for experimental plantations, without prior approval by the District Forester. On large projects, species, mixtures, and spacing will be discussed for each site in the planting survey report and in the planting plan.

Methods and Tools

Deep Hole or Center Hole Method

This method of planting will be used as a general practice. It is relatively cheap, very successful, and well adapted to most sites. It is described on Page 26 of Bulletin 475. Using this method, planters on the Monongahela average 500 or more plants per day.

Care must be used to set the tree slightly lower than it grew in the Nursery, to see that the roots are not doubled up or turned under, and to make sure that fine soil, (not sod, trash, etc.) is tamped around the roots. A grub hoe or hazel hoe, with the blade straightened so as to be perpendicular to the handle is the best tool.

Slit Method

This method (Page 23, Bulletin 475) may be used only in loose sandy soil. A planting bar is usually better than a spade or a mattock. Trees planted by the slit method, or side hole method in heavy soil are too liable to develop flattened root systems and a tendency to windthrow.

General

1. Trees must be shipped from the Nursery before growth starts. When received, open one or more bales or crates for inspection, and if the roots are dry, drench all containers with water. Transport immediately to planting site and heel in. One or more heel-in beds should be selected in advance so that no time will be lost in heeling in. Do not dip the roots in water when heeling in, but if soil is dry, wet down thoroughly, after trees are heeled in. If the stock shows any signs of heating or moulding, the bundles should be opened and spread out in the heel-in bed, retaining the strings to separate the bundles. After heeling-in,

cover with moss, burlap, or brush, and keep moist. Trees in heel-in beds should be inspected daily.

2. Each planter must carry his own trees. Ehrhart planting trays (galvanized iron), wooden trays, or the D-1 Planting Bag may be used. Damp moss or burlap must be used to protect the roots, but excess water in the carrier should be avoided.

3. With either method of planting, furrows may be plowed where feasible to do so, and the trees set in holes or slits in the furrows. The furrows should be shallow and the sod must be completely turned back. In all cases where holes are dug, the soil should not be scattered. It should be kept as close as possible to the hole. Sod or litter should sometimes first be removed with a stroke or two of the mattock, thus making it easier to get fine soil for tamping around the roots.

4. The number planted per man day depends on the method, the character of the site, the class of stock, and the experience of the planters. Careful planting, and careful supervision are essential. Work poorly done is wasted. After men have had considerable experience, they will, of course, plant faster and easier, but they should not be hurried at the beginning. All efforts at first should be directed toward showing the planters how to do the work.

Organization

Large planting jobs will ordinarily be conducted from camps. Whenever possible, camp sites will be chosen so that several seasons' work can be done from each. Ten to fifteen men and a foreman will comprise a planting crew. When necessary to have two or more crews in one camp, the best suited foreman will be designated Camp Boss. The Camp Boss will be directly responsible to the Ranger, who will be in charge of all planting on his District and should act as foreman or camp boss as much as the fire season (usually coincident with the planting season) will permit. On small jobs and experimental planting, the Ranger should always act as planting foreman. Accurate records of amount of stock received, number planted per man day, number of meals served, cost of meals, cost of surveying, and staking, etc., must be maintained.

Planters will be paid at the daily rate with board that applies to improvement work on the Forest concerned. It is often desirable to add a bonus of not to exceed 25 cents a day for men whose services are satisfactory and who stay through the entire job. Foremen, cooks, and Camp Bosses should be employed on a monthly basis. Planters will be subsisted, but not paid for Sundays and days lost due to weather conditions.

Stock should be heeled-in at points conveniently located with respect to the areas to be planted. If each planter cannot take with him in the morning sufficient stock to last him for the entire day, it will be necessary to assign one or more men as packers to keep the planters supplied with stock. Pack horses or burros may be useful.

Small Plantations

Small plantations, up to five acres, not a part of a recognized project, established by the use of contributed time, may, in the judgment of the Supervisor be classified as "unreported." Planting for landscape effects around Ranger stations, public camp grounds, etc., also falls in this class. No records need be kept of plantations in this class except that they should be mentioned in the Annual Planting Report for the year in which established. Experimental plantations to determine the species or class of stock suited to any project will never be less than one acre in extent, and should average five acres. Such plantations, must, of course, be carefully recorded.

Records and Reports

Field

Each plantation except those classed as "unreported will be surveyed, marked with durable corner posts, and will have sample rows staked. This is a part of the planting job, and must be done at the time of planting.

Corner posts scribed with the plantation designation and the date of planting, as "P-5 4/28", will be erected at the principal corners of each plantation, and shown on the map. The most durable posts available will be used, set firmly in the ground in a mound of stones (where available). Posts should be at least 4" in diameter at the small end, six feet long and painted white.

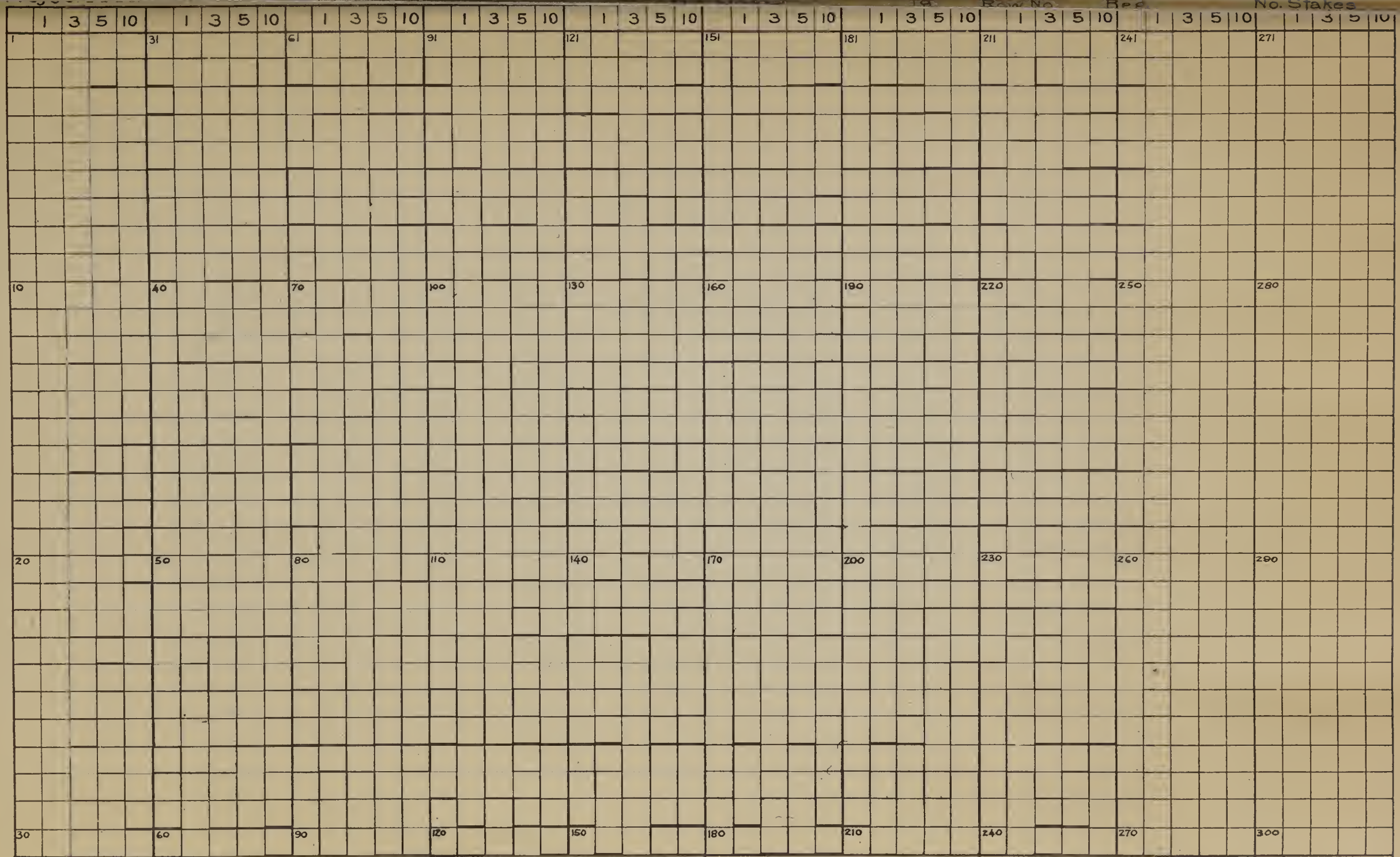
The number of rows staked in any plantation will depend upon the size of the plantation and the variation in site. A minimum row of 100 trees will be used in small plantations. The usual row for plantations of ten acres or larger, will be 200 trees. At least one row will be established for each 50 acres, with additional rows if necessary, because of variations in site, etc. Stakes will be 12" to 18" long, of durable wood, with the tips dipped in white paint. Care should be used in setting the stakes so that snow will not flatten the stake over the planted tree. Staking does not contribute to the success of the plantation, but is essential to the maintenance of satisfactory records. With this in mind, each Forest should aim to stake the necessary number of trees in each plantation in the

most satisfactory and most economical manner. Heavy lath, sawmill waste (stickers, etc.) and the strips used in baling trees will all make satisfactory stakes. The stakes must be planned for in advance of planting, and should be shipped to the planting site with the trees.

As stated in the Manual, the usual row will run diagonally across the plantation sampling each planter's work, and each site. Whenever possible, each staked row should start at a plantation corner post. Each staked row should be shown on the map of the plantation.

Form 47-D.7 is designed to use in recording the trees in the row when staked and in making the regular examinations for record. It will be made up by the Ranger or Camp Boss at the time of planting, and will be filed in the project folder and used in future examinations. Form 47-D.7 practically amounts to an individual record of each tree. In order to make sure that each staked tree is found at each examination, every tenth stake will be either numbered with an aluminum tag or marked with a timber scribe. In this way, if any stakes are missed, a check is provided once every ten stakes, and more accurate results are assured.

Row No. Rep. No. Stakes



	1st.Yr. By: _____ 19__						3rd.Yr. By: _____ 19__						5th.Yr. By: _____ 19__						10th.Yr. By: _____ 19__						Yr.	Height	
Species																											
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		Max.	Aver.
T- Thrifty																									1		
U- Unthrifty																									3		
D- Dead																									5		
M- Missing																									10		

One sheet covers four examinations of one staked row. For mixtures, indicate species in number squares.

Show condition of each tree by letter- T U D or M- in proper square. Show reproduction of valuable species occurring in mil acre

Office

The Ranger will be responsible for keeping accurate records of planting costs. Immediately after the close of the planting job, Form 134, for each plantation established, should be completed in rough draft and forwarded to the Supervisor's office, where three copies (Ranger, Supervisor, and District Office) will be made.

For Forests with major planting projects, covered by intensive surveys, a planting atlas will be maintained by the Ranger (if so directed by Supervisor), Supervisor and District Office. It will contain (1) a small scale map of the Forest, showing the location and status (with respect to planting surveys) of all planting projects, and (2) a map (scale 4" to 1 mile) of each project which has been covered by an intensive planting survey. The latter will serve as progress maps.

The survey of each plantation (made at the time of planting) will be plotted on the Supervisor's (and Ranger's) progress maps. The location of corner posts and staked rows should be shown and the plantation tied in to known corners or base line stations.

The Supervisor's progress map will be forwarded with the plantation reports to the District Office. After the District Office progress map is brought up to date, the Supervisor's copy will be returned to him. The outline of each plantation will be shown in black ink. The areas planted will be lightly tinted, using different colors to distinguish the different plantations, being careful not to obscure the basic data on the map. All copies can be tinted in the District Office. Each area will contain the number of the plantation and date of planting.

When areas are planted for which no intensive planting survey maps are available, maps and tracings will be prepared by the Ranger, using Form 878. One print will accompany each copy of Form 134.

When Form 134 is prepared in triplicate in the Supervisor's office, Form 133 will also be made up in triplicate, one copy to accompany each copy of Form 134. The dates when examinations and Form 135 are due (first, third, fifth, and tenth years after establishment) will be entered in the "date" column on Form 133. Form 133 will then serve as a promise card for Ranger, Supervisor, and District Office, showing when examinations are due.

Each year, the Supervisor's Annual Planting Report will include a memorandum listing, by projects, the plantations due for examination during the next calendar year, as well as a statement of the results of examinations made during the year covered by the report.

Plantation Examinations

Of equal importance with the establishment of plantations is their examination. This is especially true in this District, where a background of planting experience is lacking. Planting is essentially the Ranger's job, with guidance and help from the Supervisor's office. The examination of plantations on the contrary, is a function of the Supervisor. On the results of such examinations will be based important decisions regarding future planting as well as accurate reports upon past efforts. The Supervisor, or at least a competent member of his staff, should personally make the periodic examinations and prepare Form 135 on all major plantations. As in all inspection work, it is most desirable to have the Ranger accompany the Supervisor, so that results may be discussed on the ground.

As stated above, examinations will be made the first, third, fifth, and tenth years, after establishment. The most practical time to make the examination is during the progress of field planting on the same project. Spring planting is done before the vegetation greens up, and fall planting after most of the leaves are down and the annual growth is dead. These are the most advantageous times to examine plantations of evergreen species. On the contrary, it is easier and surer to examine hardwood plantations when the trees are in leaf.

Each staked row will be checked carefully for living, dead, and missing trees, and recorded on Form 47-D.7. Additional unstaked rows may be counted if necessary. General conditions over the entire area should be noted. Cause of the loss and average height are important and should be determined as accurately as possible.

Form 135 will be prepared in triplicate, using the data recorded in the field on Form 47-D.7. When received, the data will be posted on Form 133 in Ranger's, Supervisor's, and District Forester's card files, checking the date received against the date due as noted on the card. Each Form 135 should bear in the upper left-hand corner the note "first year," "third year," etc.

It will be standard practice for Supervisors to submit all Forms 133, 134, and 135 and progress maps due in one season together, as far as practicable. All are due not later than June 1 and December 15 for spring and fall planting respectively.

Planting reports and correspondence will be filed by projects. All reports will be kept in the current files until after the tenth year's examination.

Classification of Results

The number of trees planted per acre varies with spacing used and conditions on the planting site, such as brush, rocks, and natural reproduction. Success, therefore, will not be based arbitrarily upon number of trees surviving, but rather upon the percentage of healthy survivals.

Success	- 65% or more of trees planted surviving, healthy, and free to grow.
Partial Success	- 40% to 64% of trees planted surviving, healthy, and free to grow.
Failure	- Less than 40% of trees planted surviving, healthy, and free to grow.

Percentage of survival must, however, be interpreted in the light of distribution. If the surviving trees are in small groups scattered over the area, and conditions for replanting are adverse, these groups may be relied upon to function as seed trees. If extensive fail places occur, these should be considered for replanting.

In preparing Form 135, the percentage of survival will always be included under "Remarks," and the plantation classified as success, partial success, or failure. If failure, a memorandum should be attached containing a complete discussion of causes of failure, present condition of area, and recommendations for or against replanting, including cost, species, class of stock, and other pertinent data. Failed spots of less than one acre will ordinarily not be considered for replanting.

Supervisor's Annual Planting Report

This report is due in the District Office by January 15. Each Forest should submit a report each year. If no planting has been done, no plantations examined during the year and no planting proposed during the next year, a simple statement to that effect is sufficient. Forests with minor planting activities should submit only brief reports. Forests engaged in large scale planting should submit full reports following (so far as it applies) the outline given below:

1. Review the work of the year, covering the following points. (Do not repeat unessential details regarding methods and equipment that are standard, but emphasize practices and economies that have increased the efficiency of your work. Discuss also variations in methods, crew organization, implements, supply systems, protection precautions, etc.)

a. Acreage seeded and planted by projects.
Cost as compared with five-year average.

b. Method and season of planting.
Number planted per man day (planters and total)
Weather conditions.

c. Species, class of stock, number per acre, mixtures.

d. Labor conditions, wages, etc.

e. Protection from rodents, stock and fire.

f. Organization of work, camp equipment.

2. Review of past planting work.

a. Examinations made during the year.

Project	Number	Year established	No. of Thrifty Trees per A.	Per cent survival	Success, partial success or failure	Average height

Comments on unusual features.

b. Summary of results to date.

For each project give total area, area and per cent planted, also per cent successful, partially successful and failed.

Comment on relative values of various species, classes of stock, methods, etc.

c. Cleaning plantations. Is there need for cleaning? Has any cleaning been done? Cost?

3. Brief statement of reforestation policy for the Forest, recommending changes if necessary.

a. General plan for next five years.

b. Memorandum showing plantation examinations due next calendar year.

4. Seed Collection.

Statement of seed collection during the year and future plans, including costs of collection and extraction.

5. Summary.

Use mimeographed forms A, B, C, D, where applicable. These may be obtained from the District Forester:

A. Seeding and Planting.
B. Planting plan and estimate.
C. Seed collection.
D. Seed on Hand.

SHEET A

Summary to Accompany Annual Planting Report

_____ National Forest _____ Project _____, 19__. (1) Sowing Planting

(2) No.	Acres	Species	Source	Age Class	No. per Acre	Cost per Acre (1) Seed Trees	Sowing(1) Forest Officers	Planting (3) Cash	(4) D & R	Total
		(January to June)								
		(July to December)								
Total		_____	Average							

(1) Use separate sheets for Sowing and Planting. Strike out words not applicable.
(2) List each plantation or seeded area separately.
(3) Includes all cash outlays such as temporary labor, transportation, subsistence, etc.
(4) Depreciation and Reconnaissance. Refer to instructions #3 and #13 on back of Form 134.

SHEET B

Summary to Accompany Annual Planting Report

_____ National Forest _____, 19__.

1. REFORESTATION RECOMMENDED FISCAL YEARS _____ AND _____.

Fiscal Year	Project	Number Acres	Species	Season	Planting or Sowing

2. REFORESTATION ESTIMATES FISCAL YEARS _____ AND _____.

Fiscal year	Number Acres	Cost per Acre excluding trees or seed	Total Cost	Contrib. Time	Balance needed

3. ESTIMATES FOR PLANTING SURVEYS FISCAL YEARS _____ AND _____.

Fiscal Year	Project	Acres	Cost per Acre	Total Cost	Contrib. Time	Balance needed

Give for each fiscal year estimated cost tentage and miscellaneous equipment.

This form is intended to cover plans and estimates for the two succeeding fiscal years.

Give also any changes in plans and estimates for the coming spring's operations that are different from those previously submitted.

SHEET C

Summary to Accompany Annual Planting Report.

_____ National Forest

SEED COLLECTION.

(Collection Fall 19___).

Species	Method	Avg.No.Bus. Per Day Per Collector	Total Bushels Collected	Cost Per Bushel

Extraction			Cost Per Pound Clean Seed					
Species	Pounds Seed Per Bushel	Total Pounds Clean Seed	Collection	Transportation	Extraction	10% Equipment	Supervision	Total Cost Per lb.

No. bushels unextracted _____ Species _____

Transportation - Use only where relatively large expenses have been incurred in shipping or hauling cones to the extractory.

(Discuss changes or improvements in methods of collection and extraction, on a separate sheet.)

SHEET D

Summary to Accompany Annual Planting Report.

_____ National Forest. _____19__.

TREE SEED ON HAND.

Species	Actual No. of Pounds	Date of Collection	Source of Seed	Date of Last Germination Test	Germination Per Cent

Note: This does not include seed reported on Sheet C.

SEED COLLECTION

Planting stock should be grown from seed produced in the immediate region in which the stock is to be planted. Furthermore, it is possible that such characteristics as good form, rapid growth, straight grain, etc., are more or less hereditary. It is generally accepted that mature, well-formed, healthy trees produce better seed than young, deformed, suppressed trees, or those growing under less than optimum conditions. Seed should be ripened on the tree and care used during and subsequent to collection to prevent damage by fungi, excessive heat, moisture, etc. These considerations point toward the necessity for careful collection and handling of tree seed.

Each nursery must be as nearly self-supporting in regard to seed as possible. That is, it is the function of the Supervisor to make all arrangements for collecting needed supplies of seed on his Forest. When this is clearly impracticable and in cases where stock is to be raised for planting on other Forests, the District Office must be notified sufficiently far in advance of the actual need in order that suitable arrangements can be made for collection elsewhere.

Seed will not be purchased from seed dealers unless it is impossible to collect it in suitable amounts anywhere within the District, or to purchase it from other Districts.

Seed collection is of very great importance, since it is the start of reforestation. Methods of collection, extraction, and storage must be worked out locally to suit each set of needs. Careful plans for the location and collection of the best seed available are essential. Whenever it is practicable to do so, a three-year supply of seed that can be successfully stored, should be collected.

Forest Service
instructions.

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